Real Wage Convergence in an Open Labour Market*

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Abstract: This paper looks at how the Irish experience of integration has affected the labour market, bringing about convergence in labour costs between Ireland and the UK. A model of this process is developed and estimated which takes account of the fact that productive capacity and output are mobile within the EU economy and that integration affects the supply of labour through the potential for migration and changing expectations. The results indicate that changes in tax rates in the UK can affect the Irish labour market.

1 INTRODUCTION

T he relationship between economic integration and convergence of living standards has been the subject of a number of studies both at an international and a regional level, for example, Barro (1991) and Barro and Sala-i-Martin (1991). The possible effects of EU integration on peripheral regions have been widely debated in Ireland and elsewhere (Kennedy, 1992). The central importance of trade to this process of integration has focused attention on the real goods market as the channel for transmitting change. The initial shock of free trade may be felt through pressures on the price of goods and also through changes in demand due to growth in trade. Free trade

on its own can be expected to affect prices in the factor markets, including the domestic labour market. In addition to freeing of trade, the introduction of free movement of labour and capital, which have been essential components of the European integration process, can be expected to have major effects on the markets for labour and other factors. This paper looks at how the Irish experience of integration has affected the economy through the labour market as reflected in movements in labour costs.[1] In particular, it examines how the openness of the labour market has influenced the convergence in labour costs between Ireland and the UK since the 1960s.

The Irish economy over the last seventy years has provided a very interesting test-bed of the effects of economic integration. Having been an integral part of the United Kingdom until independence in 1922, there were a series of changes over the following ten years which introduced major restrictions on trade.[2] In the early 1930s very high tariffs encouraged the development of local industry to supply the domestic market resulting in a substantial growth in industrial employment. However, the new firms were very small with low productivity.

With the progressive dismantling of tariffs from the late 1950s the Irish economy, including the protected industrial sector, was opened to major new forces through the subsequent growth in trade. Two landmarks in this process were the Anglo-Irish Free Trade Agreement of 1965 and EU entry in 1973 which abolished all remaining barriers to trade with the EU.

Between 1930 and 1960 Irish industrial labour costs remained around 60 per cent of the level of labour costs in the UK. However, from 1960 to 1980 the gap between the two was closed. Ireland has not been unique in experiencing such a rapid convergence. Spain has undergone a similar upward adjustment in labour costs relative to its EU partners since the 1960s. The former East Germany is currently undergoing such a process (relative to West Germany) concentrated over an even shorter space of time. While there is only weak evidence that freeing of trade leads to convergence of labour costs at an international level (Davis, 1992), the evidence for Ireland suggests that wage rates have converged on the EU norm much more rapidly than have living standards, as measured by GNP per head (Kennedy, 1992). The corollary has been a rise in the unemployment rate to a level well above the EU norm. This paper develops a model which explains this process of convergence of labour costs.

1   Throughout this paper labour costs are defined as the cost to employers, including labour taxes, of employing a unit of labour. Unless otherwise stated, the term wage rates is treated in this paper as synonymous with labour costs.

2   There was free movement of funds within the sterling area until Irish entry into the EMS in 1979. However, until the mid 1950s, there were extensive controls on direct foreign investment in Ireland.

The traditional approach to modelling the impact of openness on wage determination assumes that the price of output and the terms of trade are the major external channels of influence (Drèze and Bean, 1990 and Layard, Nickell and Jackman, 1991). However, the free movement of capital, especially the right to invest abroad, has helped create an integrated EU production system where the location of production can be shifted from one region or country to another (Bradley and Fitz Gerald, 1988 and Pain, 1993).

The free movement of labour has also played a vital role in promoting change through its effects on the supply of labour. With the exception of the 1939-45 period, there has been unrestricted movement of labour between Ireland and the UK since the nineteenth century and migration flows have been exceptionally high by European standards over that period. A study by Williamson (1990) indicates that migration was an important factor in bringing about convergence in living standards between Ireland and Great Britain in the nineteenth century. Many studies have examined the migration mechanism in Ireland in the twentieth century (Walsh, 1974, Geary and McCarthy, 1976, and Honohan, 1992). These studies identified the difference in expected living standards between Ireland and the UK as the driving force behind labour movements between the two economies. The difference in living standards was captured by differences in unemployment rates as well as differences in remuneration.

Migration, through changing the potential labour force, can at least have an indirect effect on wage determination. This was recognised by Geary and McCarthy (1976) in their model of wage determination. As discussed in Bradley, Whelan and Wright (1993) this mechanism plays an important role in determining the dynamic adjustment of the Irish economy to exogenous shocks. However, the possibility of migration and the increasing awareness of standards of living elsewhere in the EU, especially in the UK, may have a direct effect on the utility function which underlies the supply of labour.

Section II of this paper examines the behaviour of wage rates and labour costs in Ireland and the UK over the last sixty years. Section III develops the model of wage determination in a small open economy and Section IV applies it to data for the Irish economy from 1962 to 1990. Conclusions are drawn in Section V.

II THE DATA

It is always difficult to make comparisons between the absolute levels of prices of goods or factors of production in different countries; comparisons of movements over time are easier to undertake. However, over the last twenty years the Statistical Office of the European Communities (SOEC) have

undertaken a series of surveys of labour costs, both direct and indirect, in EU members which allow a direct comparison to be made of labour costs.

In Figure 1 we have used these SOEC data to provide a benchmark com-parison between labour costs per hour in Ireland and the rest of the EU for 1988. Labour costs are defined to include wages (direct remuneration), bonuses, pension contributions, training costs and labour taxes. They provide a picture of the full cost of labour to the employer. The remuneration of employees obviously differs from the cost to the employer due to the various indirect costs associated with employment.
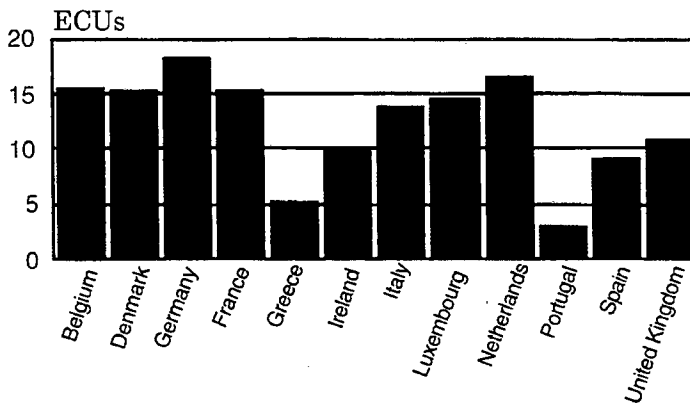

Figure 1: *Hourly Labour Costs in Manufacturing 1988*

As shown in Figure 1, Irish labour costs in manufacturing in 1988 were approximately 95 per cent of UK costs but still well below the labour costs of the original EC 6 and Denmark. Portugal had labour costs which were under a third those in Ireland.[3] The 1988 data provide a useful benchmark comparison of relative labour costs faced by firms in Ireland and the UK. Using this benchmark we have used time series data for Ireland and the UK to graph the movement in relative labour costs over the period 1925 to 1990 (Figure 2). The data used are described in more detail in Appendix 1.

The introduction of protection in the 1930s appears to have coincided with some downward adjustment in labour costs compared to the UK. Given the relative abundance of labour and shortage of capital in Ireland relative to the UK in the 1930s, it is not surprising that the move from free trade to autarchy depressed the relative return to the abundant factor in Ireland - labour. There was a substantial growth in the 1930s in the number of new

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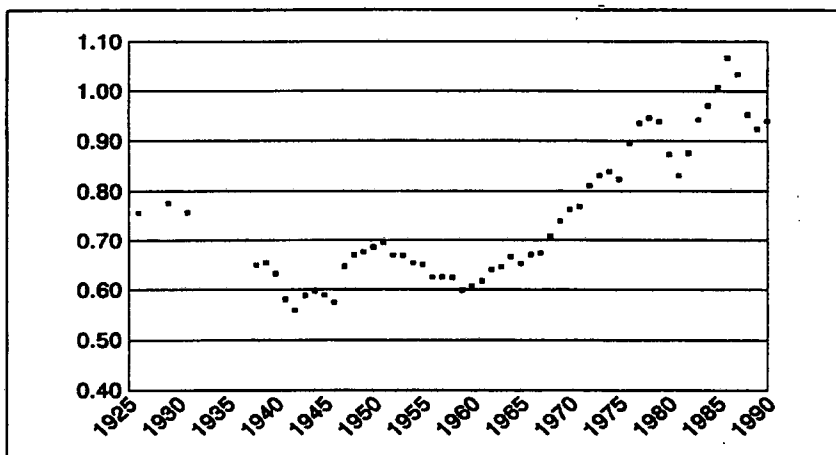3. Data for Spain and Greece were not available in the survey.

Figure 2: *Relative Wages in Industry — Ireland versus The United Kingdom*

firms with low productivity paying low wage rates supplying the protected domestic market. While factor mobility can be a substitute for trade in producing factor price equalisation (Mundell, 1957), in the case of Ireland in the 1930s, where labour mobility between Ireland and the UK was considerable, this did not prove to be the case.

The period of serious trade restrictions between 1930 and 1960 coincided with a relatively stable relationship between Irish and UK labour costs. The openness of the labour market through the migration mechanism did not bring about the conditions necessary for an equalisation of factor prices. This failure is all the more significant in the light of the very considerable net emigration from Ireland over the period.

From 1960 to 1980 the process of integration into the EU economy coincided with a relatively rapid rise in Irish labour costs compared to the UK. By the late 1970s Irish labour costs were roughly equal to UK costs. Since the late 1970s the relationship, while showing considerable variation, primarily due to exchange rate changes, has shown no obvious trend. Irish labour costs in 1978 were 95 per cent of UK costs, approximately the same level that they were in 1988.

The coincidence of the process of convergence in labour costs with the process of European integration suggests that there may be some causal relationship. International trade theory has long suggested such a relationship with factor price equalisation being possible through the mechanism of free trade.

III THE MODEL OF WAGE RATES

We outline first the more traditional closed economy structural model of the labour market from which the related model of wage determination is derived and we then develop the open economy model. These two models can each be estimated as a single reduced form equation determining wage rates. In line with the Scandinavian model of inflation we concentrate on modelling wage determination in the tradable sector; wages in the non-tradable sector follow those in the tradable sector (Bradley et al., 1993).

Closed Economy

In a closed economy model of wage bargaining a standard assumption is that firms attempt to maximise profits, subject to a downward sloping demand curve for their output (Layard, Nickell and Jackman, 1992 and Bradley, Whelan and Wright, 1993). The firm's profit function is defined by Equation (1). (Lower case variables indicate the natural log of upper case variables. The suffix i indicates a domestic variable; the suffix u indicates a foreign variable.)

$$\Pi = f(p_i, \ w_i, \ k_i, \ m_i) \qquad (1)$$

where

Π = the firm's profit k_i = the price of capital
p_i = the ouput price m_i = the price of imported inputs
w_i = the wage rate

$$\frac{\delta \Pi}{\delta w} = \frac{L_i^d}{Q_i} = f(w_i - p_i, \ k_i - p_i, \ m_i - p_i) \qquad (2)$$

where

L_i^d = Demand for labour and Q_i = Output

The firm chooses appropriate levels of output and factor inputs to maximise profits conditional on the output price and the factor input prices. Assuming constant returns to scale and homogeneity in prices, the demand for labour can be derived from the profit function by differentiating it with respect to the price of labour (Hotelling's lemma), Equation (2). In this case output per head (productivity) is a function, among other things, of the product wage.

$$L_i^s = g\left(w_i, \ z_i, \ t_i, \ \frac{Q_i}{L_i}, U_i, \ N_i \right) \qquad (3)$$

Employees, represented by trade unions, are concerned with expected real take home pay, where their expectations are affected by the probability of unemployment. As shown in Equation (3), the supply of labour (L^s) in a closed economy may be a function of a range of variables: individuals and unions will be concerned about consumer prices (z) as they attempt to preserve or improve their standard of living; the tax wedge (t) includes social insurance contributions payable by both employers and employees;[4] productivity (output per head) where employees bargain to maintain their share of output, a common practise in European labour markets (Drèze and Bean, 1990); the rate of unemployment (U) and unionisation (N). A range of other factors, such as the replacement rate and demographic variables, could also affect the supply of labour.

$$w_i^* - p_i = a_0 + a_1(z_i - p_i + t_i) + a_2(q_i - l_i) + a_3 U_i + a_4 N_i \qquad (4)$$

Employers and employees, represented by their unions, bargain over wage rates and, given the outcome of the bargaining process, the employers then set employment and output so as to maximise profits. The objectives of the two agents are described by Equations (2) and (3). The tax wedge term in the resulting equation for the real product wage, (4), incorporates an additional adjustment to take account of the difference between output and consumer prices due to indirect taxes and changes in the terms of trade. The wedge then represents the difference between the price of labour paid by employers, which includes all labour taxes, and the returns to labour after taking account of all taxes on labour, indirect taxes, and any change in the terms of trade; employees are here assumed to bargain in terms of the real after tax wage rate. For simplicity the prices of factors of production other than labour have been omitted. The star indicates that the wage rate is the optimal or desired rate which may differ from the actual rate due to adjustment costs.

Open Economy

This model of wage determination must be changed in a number of ways when moving from a closed economy to an open economy. Layard, Nickell and Jackman (1991) assume that firms' pricing in an open economy is affected by external factors and that the wedge between consumer and output prices is affected by the terms of trade. However, if the open economy is *small* then the output price is exogenously determined (Callan and Fitz Gerald, 1989). If there is free movement of capital and goods then output for the *world firm* can be sourced in a range of different locations depending crucially on

4. The tax wedge variable t_i is defined as $1/(1-t_{yi})$ where t_{yi} is the average rate of direct taxation.

the cost of production in each location (Bradley and Fitz Gerald, 1988).[5] Krugman, 1995, refers to this process of "slicing up the value chain" and its role in increasing the volume of trade. On certain conditions the world firm's supply decision can then be broken into three stages: a decision on the optimal factor mix within each country; a decision on the optimal choice of location; a decision on the profit maximising output.[6]

Optimisation may involve changing the location of output for different stages of the production process or changes in the sourcing of inputs used as part of the production process. In either case the resulting output produced by the *world firm* will be produced by a combination of factors of production drawn from many different countries. This model is consistent with both a world of multinational firms and a world of smaller firms (also price takers), each located in a single country, where their success or failure depends on the extent to which their products are purchased as inputs in the production of a composite world output. In such a model the choice of location and, therefore, decisions on employment in a region or a country depend crucially on the relative cost of production in different locations; changes in the price of labour in one country can affect employment in another and can, as a result, affect a firm's bargaining behaviour.

$$C_w = c(Q_w, w_i, ew_u, k_i, ek_u, m_i, em_u) \qquad (5)$$

We do not model the world firms' decision on optimal world output. Instead, in this open economy world, firms are assumed to minimise their world cost of production C_w,[7] consistent with producing a given world output, and given the costs of the factors in the different production locations, Equation (5). The rate of exchange between the domestic country and the rest of the world is e.

$$l_i^d - q_w = d_0 + d_1(w_i - ew_u) \qquad (6)$$

The demand for labour, as for the other factors of production, is derived from the unit cost function assuming constant returns to scale and homogeneity in prices. To make the model tractable the prices of the factors of production

5. In the case of Ireland in 1990, 55 per cent of output in domestic manufacturing came from foreign owned multinational firms.

6. Certain regularity conditions are assumed such that a cost function exists dual to the world firm's production function (Diewert, 1974). The multi-stage optimisation procedure also depends on the assumption that factors of production in each country are homothetically weakly separable from factors of production in all other countries (Bradley and Fitz Gerald, 1988, pp. 1,229-1,232).

7. The suffix w indicates that it is the cost of producing the world good including output in both the home and the foreign country.

other than labour are omitted and a simple log linear functional form is used as in Equation (6).

In addition to changing the firm's objectives in bargaining, the openness of an economy also affects the behaviour of employees and trade unions. This can occur directly as the potential labour force in one country is affected by migration, which is itself affected by labour conditions in the source and destination countries for migrants (Harris and Todaro, 1970). This has been an important factor affecting labour supply in Ireland (Geary and McCarthy, 1976 and Honohan, 1992). Migration, through changing the population and labour force, can change the domestic rate of unemployment so that even with the closed economy specification of the wage Equation (4), foreign labour market conditions can indirectly affect domestic wage rates.

The openness of the labour market can also affect the supply of labour by changing the expectations of employees who do not choose to migrate because of the social and economic costs. The effects of German unification on the labour market in the former East Germany is a good example of such an effect. The broad process of European integration improves information on living standards in neighbouring countries (or regions) giving rise to pressures for similar conditions domestically, even if the costs of migration prevent the bulk of the labour force from moving. In the case of the Irish economy this process may be enhanced by the traditional close ties between the trade union movement in Ireland and Britain. As a result, the real after tax wage rate in the foreign country can also affect domestic labour supply.

$$l_i^s = b_1 + b_2(w_i - z_i + t_i) + b_3(w_u - z_u + t_u) + b_4 U_u + b_5 N_i \qquad (7)$$

Because the migration relationship ensures that the Irish rate of unemployment is a function of the UK rate (Honohan, 1992) the exogenous UK unemployment rate is preferred in the labour supply Equation (7) over the domestic rate.[8] Both the real after tax wage rate in Ireland and in the UK appear in this supply equation where the price deflator used is that for consumer prices.

$$w_i = -\frac{(b_1 - d_0)}{(b_2 - d_1)} + \frac{1}{(b_2 - d_1)} q_w + \frac{b_2}{(b_2 - d_1)} (z_i - t_i) - \frac{(b_3 - d_1)}{(b_2 - d_1)} w_u$$

$$+ \frac{b_3}{(b_2 - d_1)} (z_u - t_u) - \frac{d_1}{(b_2 - d_1)} e - \frac{b_4}{(b_2 - d_1)} U_u - \frac{b_5}{(b_2 - d_1)} N_i \qquad (8)$$

8. In practise it performed at least as well as the domestic rate.

The two equations (6) and (7) can also be solved for the desired or "equilibrium"[9] wage rate w_i^*, equation (8). The derivation is shown in Appendix 2.

IV RESULTS

In testing the models of wage determination described by Equations (4) and (8) the ideal approach is to nest them in an encompassing model. The restrictions necessary to derive the open and closed economy models can then be tested within this framework. However, the number of coefficients necessary in the encompassing model and the limited number of degrees of freedom makes this impractical. Instead the procedure we have adopted involves testing the validity of the crucial (zero) restriction on UK wage rates in the closed economy model. This test rejects the closed economy model in favour of a more open economy specification.

In implementing the two models we assume that wage rates take time to adjust to the optimal or agreed long-term wage rate. In the case of the firm there are considerable costs to adjusting some of the factors of production in the short term. In particular, it takes time to adjust the capital stock. Thus, even if changes in factor costs suggest that it is optimal for the world firm to shift location of production, this may only be accomplished by new investment, which is expensive and takes time.

For employees adjustments in utility, which changing wage rates involves, may not be costly. This may be reflected in their bargaining behaviour as a willingness to adjust wages rapidly upwards towards their desired level. However, where their behaviour is influenced by the possibility of migration, which involves significant costs, or through the demonstration effects of foreign labour market behaviour, a somewhat slower speed of adjustment can be anticipated.

We model this adjustment process using an ECM. The closed and open economy models are applied to data for Ireland covering the period 1962 to 1990. This sample spans a period of major changes in the Irish economy as the process of integration into the EU proceeded. As discussed in Appendix 1, the dependent variable in the models estimated in this Section is average annual earnings in the industrial (tradable) sector. This variable reflects the full costs to the employer of employing a unit of labour.

Closed Economy
We first take the more traditional approach to modelling wage determination in a closed economy, Equation (4). We then augment it by the inclusion

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9. This does not imply that this wage rate is the full employment wage rate, only that, given the objectives of the bargainers, it equates the demand and supply of labour.

of the UK real after tax wage rate. If this variable proves significant this rejects the closed economy hypothesis.

$$\Delta \log(w_i) = \gamma_1 \Delta \log(w_i^*) + \gamma_2 \left\{ \log(w_{i_{-1}}^*) - \log(w_{i_{-1}}) \right\} \qquad (9)$$

In estimation Equation (4) is substituted into the ECM which models the adjustment of the actual wage rate to the desired wage rate. The ECM takes the form shown in Equation (9) where w_i^* represents the desired wage rate, specified in Equation (4).

The sources of the data are described in Appendix 1. The tax wedge term $(z_i - p_i + t_i)$ takes account of the wedge between employers' labour costs and employees' after tax earnings as well as the wedge between industrial output prices and consumer prices. The unemployment rate used is the average of the Irish rate for the current and the previous year. The unionisation variable (N_i) measures the proportion of the non-agricultural labour force which is unionised. The output price (p_i) is the price of gross output in manufacturing industry. The UK Earnings variable (w_u) is average earnings for the economy.

The results from estimating the wage rate equation, using non-linear least squares, are shown in Table 1. The fit of the equation is reasonably satisfactory. The coefficient γ_1 suggests quite rapid, though not instantaneous, response by Irish wage rates to changes in the exogenous variables. The coefficient γ_2 is not quite significant casting doubt on the existence of an equilibrium closed economy relationship determining wage rates.

The coefficient on the tax wedge variable, a_1, is not significantly different from one suggesting a full pass through of changes in tax rates to the nominal wage. Of course the final impact of the taxes can only be estimated using a

Table 1: *Results for Closed Economy Model*

Coefficient	Value	t Statistic
a_0	−1.3107	2.8
a_1	0.9305	4.1
a_2	0.4845	4.4
a_3	−0.0165	2.7
a_4	0.0395	3.3
γ_1	0.5682	3.3
γ_2	0.4844	2.1
$\bar{R}^2$	0.8219	
St. Error	0.0226	
DW	1.95	

full model of the economy which can take account of the changes in employment and output which such an increase in earnings would induce.

The coefficient a_2 on domestic productivity suggests that labour's share of output is declining — wage rates only reflect half the rise in productivity. This result must be compared to the results in Drèze and Bean (1990) where measured productivity gains in a range of European countries were found to be passed rapidly through to wages.

The specification used here for the unemployment variable implies hysteresis: a rise in the unemployment rate produces a once-off change in the real wage; after the initial change in wage rates there is no continuing pressure on the rate of *change* in wage rates sufficient to restore unemployment to its original level. In this form the coefficient on the unemployment rate variable, a_3, is just significant with the expected negative sign. Finally, the coefficient on the unionisation variable, a_4, is significant with the expected positive sign.

$$w_i^* - p_i = a_0 + a_1 t_i + a_2(q_i - l_i) + a_3 U_i + a_4 N_i + a_5(\dot{w}_u - z_u + t_u) \qquad (10)$$

Table 2: *Results for Augmented Closed Economy Model*

Coefficient	Value	t Statistic
a_0	−6.2096	6.1
a_1	0.7740	6.4
a_2	0.2238	2.7
a_3	−0.0038	1.2
a_4	0.0183	3.4
a_5	0.7753	5.7
γ_1	0.9299	6.7
γ_2	0.5967	2.6
$\bar{R}^2$	0.9188	
St. Error	0.0153	
DW	1.9	

When the real after tax wage rate in the UK, $(w_u - z_u + t_u)$, is added to the closed economy model by replacing Equation (4) with Equation (10) the closed economy model is rejected (Table 2). The key coefficient on the UK wage rate, a_5, is highly significant with a value which is not significantly different from unity. The overall fit of the equation is substantially improved by the inclusion of the additional term.

The coefficient γ_1 is not significantly different from unity indicating that

Irish wage rates adjust instantaneously to changes in the desired or equilibrium wage rate. The significance of the coefficient on γ_2 suggests the existence of such an underlying relationship. The coefficient on productivity, a_2, is greatly reduced, though it is still significantly different from zero. The coefficient on the tax wedge, a_1, is also reduced in magnitude and unemployment, while having the correct sign, is no longer significant.

Open Economy

The *ad hoc* inclusion of UK earnings and its vital importance in determining Irish labour costs in Equation (10) suggests the importance of modelling directly the openness of the Irish labour market. We implement here the open economy model of wage determination set out in Equation (8). For estimation purposes this equation is rewritten as Equation (11) and substituted into the ECM, Equation (9). The structural coefficients, with the exception of d_0 and b_1, can be separately identified.

$$w_i^* = c_0 + c_1 q_w + c_2(z_i - t_i) + (1 - c_2)e + c_3 w_u$$
$$+ (1 - c_2 - c_3)(z_u - t_u) + c_4 U_u + c_5 N_i \tag{11}$$

where

$$c_0 = -\frac{(b_1 - d_0)}{(b_2 - d_1)}, \quad c_1 \frac{1}{(b_2 - d_1)}, \quad c_2 = \frac{b_2}{(b_2 - d_1)}, \quad c_3 = -\frac{b_3 + d_1}{(b_2 - d_1)},$$

$$c_4 = -\frac{b_4}{(b_2 - d_1)}, \quad c_5 = -\frac{b_5}{(b_2 - d_1)}$$

Because of the volatility of the exchange rate (Irish pounds per pound sterling) over the 1979-90 period it was assumed that firms and employees react to the expected exchange rate, proxied by a four year moving average. It made little difference whether the unemployment rate used was the domestic rate or the rate for the United Kingdom. As a result, the UK rate was preferred, being a truly exogenous variable.

The tax wedge term in this equation reflects the wedge between employers' labour costs and employees' after tax earnings. The model, consisting of Equations (9) and (11), was estimated using non-linear least squares and the estimation results are shown below in Table 3.

The overall fit of this equation is substantially better than that for the closed economy model, though similar to that for the closed economy model augmented by the real after tax UK wage rate. The significance of γ_2 suggests

the presence of an equilibrium relationship as described by Equation (8). The coefficient γ_1 is also significant and, together with γ_2, they both imply quite a rapid adjustment of the actual to the "equilibrium" or desired wage rate.

Table 3: *Results for Open Economy Model*

Coefficient	Value	t Statistic
c_0	−7.1606	3.9
c_1	0.1672	1.5
c_2	0.6054	2.5
c_3	0.9075	4.9
c_4	−0.0016	0.4
c_5	0.0238	4.0
γ_1	0.7708	5.2
γ_2	0.5939	3.5
$\bar{R}^2$	0.9128	
St. Error	0.0158	
DW	1.97	
Implied structural coefficients		
a_1	−2.36	
b_2	3.62	
b_3	−3.07	
b_4	0.0096	
b_5	−0.1420	

The coefficient on the UK wage rate, c_3, is well defined and is not significantly different from unity implying a complete pass through of UK wage inflation into the Irish economy. The timing of this transmission will be affected by movements in exchange rates.

While the parameters of the structural equation for labour demand imply a very high own elasticity of demand for labour in the industrial sector, a_1, another study for Ireland (Bradley, Fitz Gerald and Kearney, 1993) has found a similar long-run own elasticity of demand for the traditional manufacturing sector when output is mobile. [10]

The coefficient on the UK unemployment rate, c_4, is not significant though it has the right sign. The coefficient on the rate of unionisation, c_5, is well

10. On a closed economy basis, with fixed output, the elasticity was very low. However, when allowance was made for the possibility of shifting the location of output, a much higher own elasticity of demand for labour was obtained.

determined implying a significant positive effect on wage rates from this factor through its effects on the supply of labour.

The specification imposes a unitary elasticity on the wage rate demanded by employees with respect to the tax wedge. However, given the relatively equal strengths of the two parties to the bargaining process, the eventual direct impact of a one percentage point rise in the tax wedge will be a rise of a little over 0.6 percentage points in labour costs with the direct incidence of the tax being shared relatively evenly between employers and employees.

The results shown in Tables 2 and 3 confirm the importance of developments in wage rates in the UK in determining wage rates in Ireland over the last thirty years. Economic integration has affected domestic labour cost developments through changing conditions for both the demand and the supply of labour. The effect of these changes has been to promote a convergence in wage rates between the two economies.

Integration of the two economies also means that changes in tax rates in the UK can indirectly affect labour costs in Ireland. The results suggest that when direct taxes were cut in the UK in the 1980s labour costs rose for Irish employers as they had to match some of the improvements in after tax wages available in the UK.

V CONCLUSIONS

In this paper we have developed a model of wage determination in an open economy which allows for the fact that productive capacity and output are mobile within the EU economy. It also takes account of the fact that European integration can significantly affect the supply of labour through the potential for labour migration and changing expectations. The model allows separate identification of some key parameters of the underlying structural model of the labour market.

The application of the model to data for the Irish economy showed that UK labour costs play a major role in determining labour costs in Ireland. The transmission of shocks from the UK to the Irish labour market takes place both through the demand and the supply of labour. To the extent that it has happened through the demand for labour it highlights the importance of free trade in promoting factor price equalisation. However, the results suggest that changes in the expectations of the work force consequent on economic integration have also been important in bringing about the convergence in labour costs between the Irish and the UK economies over the last thirty years.

The movement from a closed economy low labour cost equilibrium to a new equilibrium of parity with UK labour costs involved a continuing loss of

competitiveness *vis-à-vis* the UK. This adjustment took place relatively rapidly. Other studies have indicated that the capital stock is slow to adjust to changing circumstances (Bradley, Fitz Gerald, and Kearney, 1993) so that while labour costs may have adjusted fully to economic integration, the capital stock may lag behind. This could explain some of the exceptional rise in structural unemployment in the Irish economy. A similar process may also help explain the current high level of unemployment in Spain.

The closed economy model of wage determination, where there is a unitary elasticity on domestic productivity, implies that much of the benefits of growth will accrue as higher labour costs rather than higher employment. This link is broken in the open economy model. If the UK rate of productivity growth determines the rate of real wage inflation in the UK it will also determine the rate of wage inflation in Ireland in the future. If total factor productivity is higher in Ireland then Irish competitiveness would tend to improve over time resulting in increased employment growth. By contrast Borooah and Lee, 1991, show that in the Northern Ireland economy, while absolute labour costs are determined in the UK labour market, as in the Republic of Ireland, total factor productivity is lower giving rise to rising relative unit labour costs, with a consequential cost in terms of employment.

The experience of Ireland may have important lessons for other European countries such as Portugal where labour costs are still well below the EU norm. If economic integration results in labour costs in those countries adjusting more rapidly than the capital stock to the new environment there could be a rapid rise in unemployment.

The results also suggest that the openness of the labour market places restrictions on fiscal policy. Changes in taxes in Ireland or the UK can affect the price of labour in Ireland with consequences for the competitiveness of the Irish tradable sector. If the Irish tax rate rises then Irish labour cost competitiveness *vis-à-vis* the UK will deteriorate. If UK tax rates fall it will lead to demands for increased wage rates in Ireland once again affecting competitiveness. This result is rather similar to the findings of Kanbur and Keen (1993) for indirect tax competition between a large and a small country.

Finally, the relative insignificance of the unemployment rate in both the closed and the open economy models has important implications for how the Irish economy reacts to shocks. It means that the traditional Phillips curve, an important mechanism for reducing unemployment, is weak or missing in the Irish economy. However, without the possibility of emigration the economy might have behaved very differently in the past with labour costs responding to rising unemployment in a manner more in line with the EU norm.

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APPENDIX 1

The Data

w_i Wage bill, including employers' social insurance costs, divided by employment, industry, Ireland, *National Income and Expenditure*.

w_u Wage bill, including employers' social insurance costs, divided by employment, total economy, United Kingdom, OECD *Economic Outlook* database.

Q_i Value added in the Industrial sector, constant 1985 prices, Ireland *National Income and Expenditure*.

Q_w Volume of manufacturing output, OECD, index.

z_i Consumer prices, Ireland, value of consumption divided by volume at 1985 prices. *National Income and Expenditure*.

z_u Consumer prices, United Kingdom, value of consumption divided by volume at 1985 prices, OECD *Economic Outlook* database.

p_i Price of manufacturing output, Ireland, value of manufacturing output divided by volume index, *Census of Industrial Production*.

t_i Wedge between Irish employers' labour costs and employees' after tax earnings. It is defined as the average direct tax rate, including the social insurance costs of both employer and employee or one minus the ratio of personal income to personal disposable income.

t_u Wedge between British employer's labour costs and employees' after tax earnings, OECD *Economic Outlook* database.

U_i Rate of Unemployment, Ireland, labour force basis.

U_u Rate of Unemployment, United Kingdom, OECD *Economic Outlook* database.

L_i Employment in Industry, Ireland, labour force.

N_i Proportion of Labour Force Unionised.
  e Stg£/IR£ exchange rate.

All variables come from either the ESRI - Department of Finance or the OECD *Economic Outlook* databanks except for N_i which is from Roche and Larragy (1993). The average annual earnings data have been preferred in estimation over wage rate data as they include the other labour costs facing employers, chiefly labour taxes. The growth in taxes on labour over the sample period has been an important factor in the rise in labour costs facing employers.

The sources of the data for Figure 2 are:

Ireland:
1925-47, Wage bill in transportable goods industry divided by employment, *Census of Industrial Production*, CSO, Stationery Office, Dublin, various issues.
1947-53, Weekly wage index, transportable goods industries, *Irish Trade Journal,* CSO, Stationery Office, Dublin, various issues.
1953-90, Wage bill in industry divided by employment in industry, *National Income and Expenditure*, CSO, Stationery Office, various issues.

United Kingdom:
1925-35, Weekly Money Wage Rates, Mitchell and Deane (1976, p. 345).
1935-47, Index of Weekly Wages, UK *Statistical Abstracts*, HMSO various issues.
1947-90, Wage bill divided by employment, UK National Accounts, HMSO various issues.

The 1953-90 average earnings series for Ireland and the UK are extended backwards using the other sources cited above. The ratio of Irish to UK wages is then scaled to be equal to 0.953 in 1988, which is the ratio of relative wages for 1988 (SOEC, 1992).

   The pattern of convergence between 1960 and 1990 shown in Figure 2 for labour costs for the industrial sector as a whole can be detected also at the level of individual manufacturing sectors. The data for the earlier period, which indicate a relatively stable relationship over time, mask significant changes in the composition of industrial employment, changes which reflected the introduction of protection in the early 1930s. Thus O'Rourke (1994), using data for wage rates for selected occupations, finds a rather different pattern.

APPENDIX 2

Derivation of Open Economy Model

The demand for labour in an open economy is given by A1

$$l_i^d - q_w = d_0 + d_1(w_i - ew_u) \tag{A1}$$

The supply of labour is defined as

$$l_i^s = b_1 + b_2(w_i - z_i + t_i) + b_3(w_u - z_u + t_u) + b_4U_u + b_5N_i \tag{A2}$$

The intersection of the firms' demand for labour and the unions labour supply function determines the wage rate. However, the resulting wage rate, which is the outcome of a bargaining process, differs from the market clearing wage which would correspond to full employment. The point of intersection is obtained by subtracting Equation A1 from Equation A2:

$$q_w = (b_1 - d_0) + (b_2 - d_1)w_i - b_2(z_i - t_i) + (b_3 + d_1)w_u$$
$$- b_3(z_u - t_u) + d_1e + b_4U_u + b_5N_i \tag{A3}$$

Rearranging gives:

$$w_i = -\frac{(b_1 - d_0)}{(b_2 - d_1)} + \frac{q_w}{(b_2 - d_1)} + \frac{b_2(z_i - t_i)}{(b_2 - d_1)} - \frac{(b_3 + d_1)}{(b_2 - d_1)}w_u$$
$$+ \frac{b_3}{(b_2 - d_1)}(z_u - t_u) - \frac{d_1}{(b_2 - d_1)}e - \frac{b_4}{(b_2 - d_1)}U_u - \frac{b_5}{(b_2 - d_1)}N_i \tag{A4}$$

Setting:

$$c_0 = -\frac{(b_1 - d_0)}{(b_2 - d_1)}, \quad c_1 = \frac{1}{(b_2 - d_1)}, \quad c_2 = \frac{b_2}{(b_2 - d_1)},$$

$$c_3 = -\frac{b_3 + d_1}{(b_2 - d_1)}, \quad c_4 = -\frac{b_4}{(b_2 - d_1)}, \quad c_5 = -\frac{b_5}{(b_2 - d_1)}$$

The resulting equation to be estimated is given by:

$$w_i^* = c_0 + c_1q_w + c_2(z_i - t_i) + (1 - c_2)e + c_3w_u$$
$$+ (1 - c_2 - c_3)(z_u - t_u) + c_4U_u + c_5N_i \tag{A5}$$